

**Citizen Science Epidemiological Research Study
of
Urinary Calculi in Wethered Goats
by The North American Packgoat Association**

Introduction

The North American Packgoat Association (“NAPgA”), a 501(c)(3) nonprofit corporation, has formed a Urinary Calculi Research Committee (the “Committee”), consisting of six (6) general members and two (2) Board Members of NAPgA. The purpose of the Committee is to engage a highly qualified epidemiologist(s), researcher(s), laboratories, other professionals, and necessary parties as well as goat owners from among NAPgA’s members to organize and conduct a Citizen Science¹ Epidemiological Research Study of Urinary Calculi in Wethered Goats. The study will be a scientifically sound research project resulting in a written report intended for publication and peer review.

Objective

To identify possible effects of diet, water, minerals, body condition, age and method of castration, animal husbandry, geographic and environmental factors associated with the development of urinary calculi in wethered goats used as pack animals and related optimal standards for the prevention thereof.

Current and Future Significance/Impact of the Study

Urinary Calculi affects male goats, particularly wethered goats, at an alarming rate in nearly all user groups such as dairy, fiber, meat, show, 4-H, special purpose (brush control and packgoats), and pets and across all breeds including Nigerian Dwarf, Pygmy, Alpine, Oberhasli, LaMancha, Saanan, Sable, Toggenburg, Kiko, Nubian, Boers, Angora, Cashmere, and others. One of the primary goals of the Committee is that this study, when completed, will serve as a platform for further studies related to this deadly disease. For example, Committee member, Maggie Highland, DVM, PhD, DACVP, Assistant Professor, Veterinary Anatomic Pathologist, Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State Diagnostic Laboratory, has offered to use the data obtained from surveys and urinary tracts recovered from wethered goats that die during this study to research the effects of the age and method of castration on urethral diameter in wethered goats.

¹ The terms *citizen science* and *citizen scientists* entered the [Oxford English Dictionary](#) (*OED*) in June 2014. “Citizen science” is defined as “scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”. “Citizen scientist” is defined as: (a) “a scientist whose work is characterized by a sense of responsibility to serve the best interests of the wider community (now rare)”; or (b) “a member of the general public who engages in scientific work, often in collaboration with or under the direction of professional scientists and scientific institutions; an amateur scientist.” From Wikipedia

Background

The study is expected to begin on or before June 1, 2022. The initial length of the study will be three (3) years at which time a thorough research report will be produced and published for peer review. The Committee hopes to maintain a high level of member participation and obtain the necessary funding to extend the study for at least one (and preferably two) additional three (3) year period(s). Prior to the commencement of the study, NAPgA will circulate a voluntary survey to its members to obtain a variety of information from survey respondents. The survey will include questions related to the number of years of goat ownership, city/state/county of residence, herd size, age and breeds of goats, feed and water program information, animal husbandry and housing practices, an assessment of respondent's potential commitment to participate in a long-term research study, and an extensive array of data regarding the goats and farms enrolled in the study.

The Committee, with the assistance of a Co-Investigator, will select a representative group of survey respondents that meet the study parameters and invite those respondents to complete an application to participate in the study. Application packets sent to potential study participants will include the specific study parameters, financial obligations of NAPgA and the study participants, requirements and expectations of study participants, and other necessary relevant information. Applications will be reviewed and approved (or denied) by the Committee and the Co-Investigator without bias or prejudice to ensure a well-rounded representative sample of packgoat owners from throughout, at a minimum, the Western half of the United States.

A "Welcome Packet" consisting of a Memorandum of Understanding/Agreement, educational and instructional materials, treatment protocols and recommendations, clear instructions and guidelines for required study protocols, and other relevant documents will be mailed to study participants well in advance of the commencement of the project. The Committee will follow up with verbal communication to ensure participants fully understand the information in the "Welcome Packet."

NAPgA Team

The Committee members are experienced goat owners who have many years of collective experience in breeding and raising goats, including wethered male goats, for use for dairy and meat production, packing, carting, showing, 4-H, pets, and other purposes. The Committee members have the experience, training, dedication and work ethic necessary to design and oversee this study. Committee members include a diagnostic researcher, business owners, goat breeders, and producers who all understand the importance of fiscal responsibility, time and task management, legal and personal privacy issues. Some of them own goats that have survived urinary calculi and/or experienced the loss of goats due to urinary calculi obstruction (urolithiasis).

Co-Investigator

Meera Heller, DVM, PhD, DACVIM, is serving as co-investigator and assisting with project design for this study. Dr. Heller is an Associate Professor of Clinical Livestock Medicine at the Department of Medicine and Epidemiology in the School of Veterinary Medicine at the University of California Davis.

Dr. Heller and the Committee will recruit additional researchers, epidemiologists, statisticians, laboratories, universities, or other qualified parties to assist with the diagnostic, histopathology, epidemiological, statistical analysis and other components, as needed, to complete the study.

Study Participants

The Committee has established certain goals and requirements related to the study participants. At this time, these goals and requirements are as follows:

1. A minimum of fifty (50) participating farms will be included in the study. (The Committee hopes that the number of farms that actually participate in the study will be 100 or more farms.)
2. The goal will be that participant farms will have a minimum of four (4) wethered packgoats when the study begins. In order to ensure a geographically diverse group of participant farms and in order to ensure the desired number of wethered goats are included in the study, the Committee, at its discretion, may allow participant farms with less than four (4) but at least two (2) wethered goats in the study. It is estimated the actual average number of wethered goats on each participating farm will be six (6) wethered goats. Participating farms may include intact male goat kids that will be castrated by the time the goat reaches one (1) year of age or within one (1) year of the date the study begins, whichever is later.
3. At a minimum it is expected that participating farms will be located in Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, and New Mexico. Additional states, with NAPgA members who own a sufficient number of goats to participate in the study, are also expected to be represented in the study.
4. A minimum of 300 wethered goats will be included in the study. It is anticipated the actual number of wethered goats included in the study will exceed 600.
5. The initial length of the study will be 3 years at which time a complete research report will be prepared. It is hoped that the study will then continue for one or more additional 3-year period(s) with research reports being prepared at the end of each such period.
6. Participating farms will be required to be members of NAPgA.

Funding

During its November 2021 meeting of the Board of Directors, NAPgA allocated a minimum of \$10,000 from a dedicated research fund (“The Carolyn Eddy Fund”) established by one of its founding members, the late Carolyn Eddy, in order to begin this long-term study. Since the initial funding was allocated by NAPgA two months ago, an additional \$10,000 has been donated to NAPgA specifically for this study. The current amount of cash on hand dedicated to the study is \$20,000. NAPgA is willing to allocate additional funding, if needed, however NAPgA and the Committee are soliciting private and corporate donations, grants, and other outside financial assistance to fund this study.

Anticipated (and Estimated) Costs of the Study

NAPgA’s Costs: The Committee intends to engage Ward Laboratories (www.wardlab.com) located in Kearney, Nebraska to conduct initial hay/browse and water analysis for each participating farm as well as bi-annual hay/browse analysis and follow-up water analysis as needed if there is a change in a participating farms water source. Because wethered goats of all ages, young and old, will be included in the study, the potential length of the study (minimum of 3 years up to as many as 9 years), the frequency and level of mortality associated with urinary calculi, and the need to necropsy all goats that die during the study, the Committee anticipates a significant number of necropsies will need to be performed during the study. In addition, all uroliths recovered from any goats diagnosed, treated, and that survive treatment for urinary calculi as well as those that do not survive the term of the study will be sent to the Minnesota Urolith Center for a complimentary analysis of the uroliths. NAPgA will cover the shipping costs associated with submitting the uroliths for analysis. NAPgA intends to cover a portion of the costs to perform a necropsy as well as associated shipping and lab fees, for all goats that die during the study. The exact amount of these costs that NAPgA will cover has not been determined at this time but it is anticipated that the amount will offset the majority of any expense incurred by those enrolled in the study.

Researcher’s Costs: Dr. Heller has generously agreed to donate her time to complete the diagnostic and reporting aspects of the study free of charge. NAPgA will cover Dr. Heller’s reasonable and necessary out of pocket expenses that are incurred, if any, as part of this study. It is likely that an epidemiologist and/or professional statistician will be needed to assist with the statistical analysis of data obtained throughout the course of the study. The cost, if any, of engaging an epidemiologist and/or professional statistician is unknown at this time. This paragraph will be updated once this has been determined.

Participant’s Costs: The Committee is still discussing the financial commitment that may or may not be required from study participants in addition to paying for their own feed, minerals, vaccinations and veterinary care, and other common costs of goat ownership. In addition to the foregoing, participants will be required to obtain necropsies for any of their goats that are included in the study that die during the term of the study. The financial commitment required from study participants will be clarified and/or determined prior to the beginning of the study and this paragraph will be updated accordingly.

Estimated Budget

	Assuming Minimum 50 Farms and 300 Wethered Goats			Totals	Assuming Minimum 100 Farms and 600 Wethered Goats			Totals
	Number	Unit Cost	Total		Number	Unit Cost	Total	
First year budget estimates:								
Year 1 – initial hay/browse analysis	50	\$10.40	\$520.00		100	\$10.40	\$1,040.00	
Year 1 – initial water analysis	50	\$15.11	\$755.50		100	\$15.11	\$1,511.00	
Year 1 – second hay/browse analysis	50	\$10.40	<u>\$520.00</u>		100	\$10.40	<u>\$1,040.00</u>	
				\$1,795.50				\$3,591.00
Second year budget estimates:								
Year 2 – first biannual hay/browse analysis	50	\$10.40	\$520.00		100	\$10.40	\$1,040.00	
Year 2 – second biannual hay/browse analysis	50	\$10.40	<u>\$520.00</u>		100	\$10.40	<u>\$1,040.00</u>	
				\$1,040.00				\$2,080.00
Third year budget estimates:								
Year 3 – second biannual hay/browse analysis	50	\$10.40	\$520.00		100	\$10.40	\$1,040.00	
Year 3 – second biannual hay/browse analysis	50	\$10.40	<u>\$520.00</u>		100	\$10.40	<u>\$1,040.00</u>	
				\$1,040.00				\$2,080.00
Other budget estimates for three year period:								
Estimated Cost of shipping uroliths for analysis	15*	\$25.00	\$375.00	\$375.00	30*	\$25.00	\$750.00	\$750.00
Estimated cost of necropsies, shipping & lab	45**	\$300.00	\$13,500.00	\$13,500.00	90**	\$300.00	\$27,000.00	\$27,000.00
Estimated cost of liver/mineral panel lab work	45**	\$100.00	\$4,500.00	\$4,500.00	90**	\$100.00	\$9,000.00	\$9,000.00
Estimated misc. costs (materials, supplies, shipping, etc.)	1	\$1,000.00	\$1,000.00	\$1,000.00	1	\$1,750.00	\$1,750.00	\$1,750.00
Total for 3 year study				\$23,250.50				\$46,251.00
<p>*Assumes an estimated mortality rate of 5% caused by urinary calculi. This estimate is based on the frequency of urinary calculi diagnosis in the past 10 years that have occurred in the herds of 130 members who responded to an informal membership survey completed December 8, 2021.</p> <p>**10% mortality rate from all other causes is a rough estimate.</p>								

Outline of Study Parameters

1. Preliminary Testing
 - a. Hay/Browse – one initial analysis at the beginning of the study and bi-annual analysis during the term of the study
 - b. Water - initial water analysis and follow-up analysis if water source or conditions change during the study (change in water source, use of a water softener, etc.)
2. Body Condition Score / Weight
 - a. Quarterly reporting of Body Condition Scores
 - b. Quarterly reporting of individual goat weights (scale weight if possible, weight tapes are acceptable.)
3. Data collection via surveys
 - a. Pre-Survey Study – general information such as city, county, state, length of goat ownership, number of goats, breeds, ages, sexes/castration, use of loose minerals/ammonium chloride/baking soda/apple cider vinegar, vaccine protocols (CD&T, BoSe, copper bolus, etc.), age and method of castration
 - b. Quarterly Surveys – update information contained in Items 2a, 2b, and 3a above plus: frequency, length, etc. of hikes/pack trips during the preceding quarter, any changes to feed, water, minerals, access to pasture, health changes (parasites, pneumonia, etc.)
4. Postmortem Necropsy, Urolith Analysis and Survey - All animals that die will be necropsied and the urinary tract collected whole: kidneys, ureters, bladder (emptied using a needle and syringe prior to sending), and full length of urethra from bladder through urethral process. All recovered calculi and urinary tracts will be sent to Committee member Maggie Highland, DVM, for submission of calculi to the Minnesota Urolith Center (University of Minnesota) and for tissue/organ analysis, including histopathologic evaluation to specifically examine urethral inner diameter/circumference.
5. Conclusion/Post-Study Survey
6. Completion Research Report
7. Submission of Research Report for publication and peer review